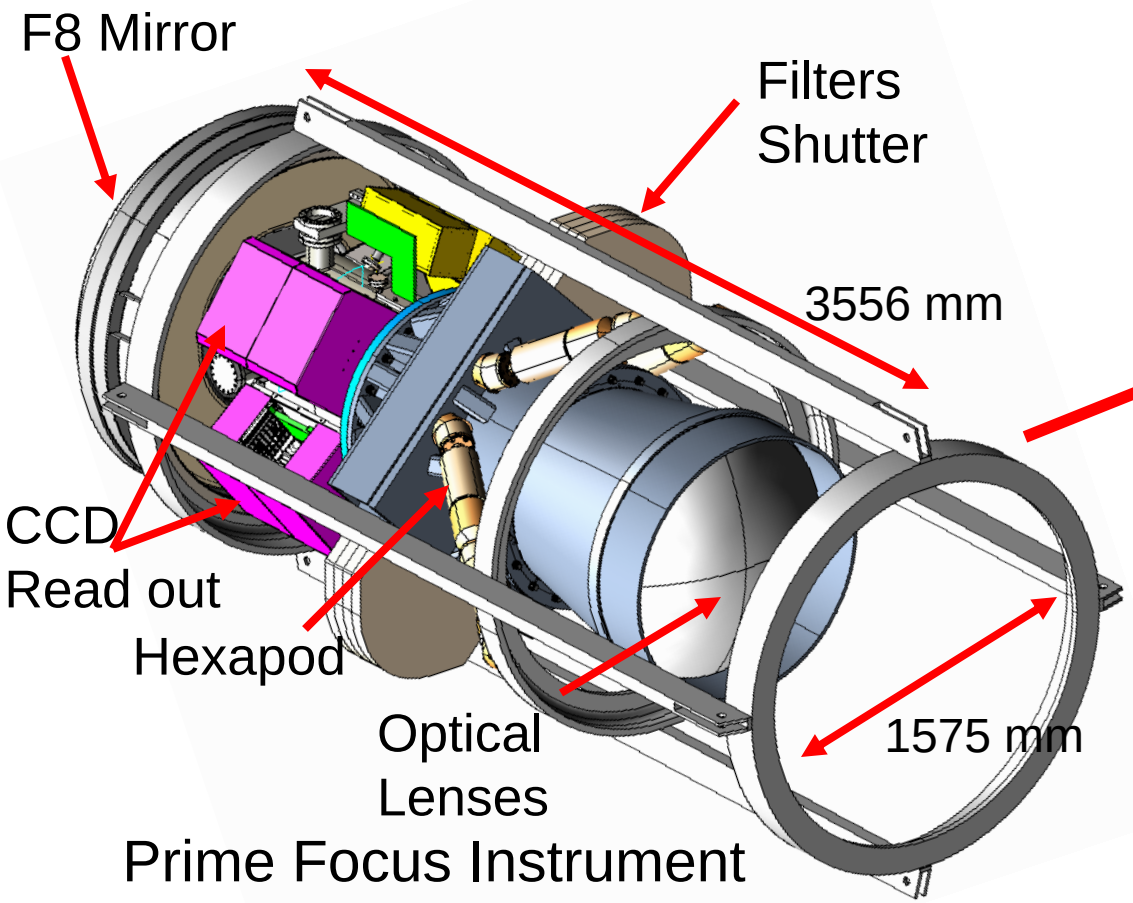
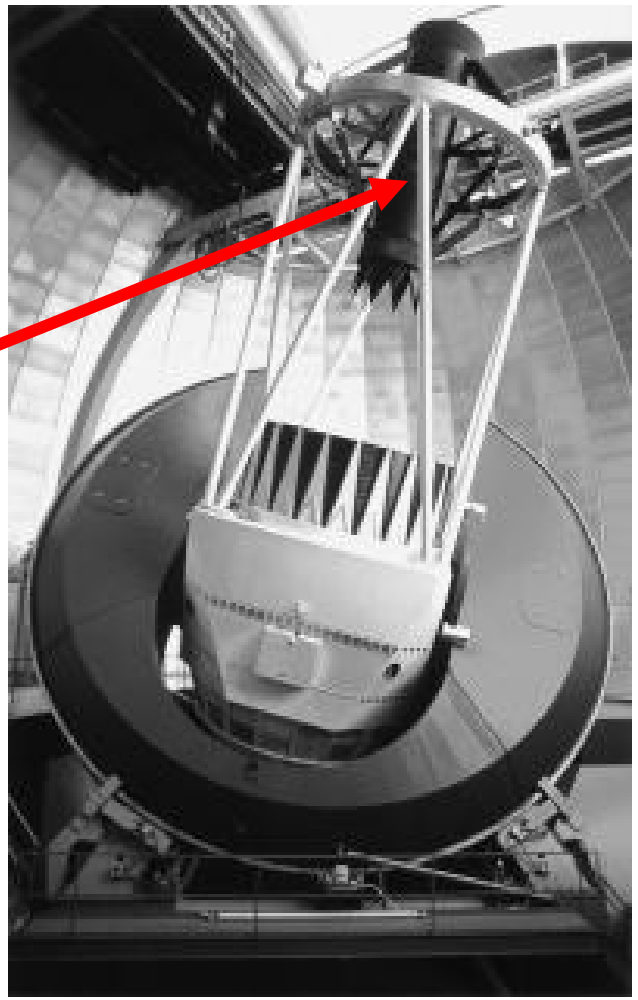
The DES Instrument: DECam

DARK ENERGY SURVEY

DECam replaces the prime focus cage on the Blanco





Prime Focus Instrument
-in optical path
-space and thermal constraints

DECam Funding Need Profile (Dec 06)

(then yr $, Overhead included)

	FY2007	FY2008	FY2009	FY2010	FY2011	Total	
DOE MIE	**0**	**6.42**	**7.11**	**4.98**	**0.54**	**19.05**	
DOE R&D	4.03	1.49	0	0	0	5.52	
DOE TPC	**4.03**	**7.91**	**7.11**	**4.98**	**0.54**	**24.57**	*

*Additional $7.7M in External funds from Non-DOE sources

- DECam is applying for R&D funds in FY07-FY08.
- The Program announcement is for one year starting in June (doesn't match fiscal year boundaries)
- DECam R&D tasks finish in early 08 (~March)
- We need $2.1M in M&S funds for R&D in FY07-08 to stay on schedule:
- $1.5M procurements from FNAL, $0.5M to go to/thru LBNL for CCDs, $0.15M for engineering support from Universities
- It is important that we get on the sky in 2010.

Draft Costs in R&D Proposal: M&S

	$k INC OH	bare
Travel	**87**	75
CCD wafers	**491**	425
CCD packaging	**146**	126
CCD testing	**334**	289
FEE	**207**	179
Filter	**225**	195
Camera	**232**	201
Electronic crates	**176**	152
Barrel	**191**	165
SISPI	**69**	60
Total	**2156**	1867

- Juan explained the goals of the CCD testing R&D
- Greg explained the packaging R&D
- Terri explained the FEE R&D
- I will briefly explain each of the rest.

CCD procurement plan

- Yield can vary between lots but is fairly uniform within a lot
- When Dalsa gets started – processing can proceed quickly (8-12 weeks) but sometimes we are not their highest priority
- Processing at LBNL takes ~12 weeks for the first 5 wafers and then can sustain a rate of 5 wafers/month.
- Processing at Dalsa is ~ 6k/wafer, processing at LBNL is $18.5k/wafer

R&D Plans:

Done – Develop a mask with four 2kx4k CCDs to minimize processing costs

Done – Order 1 Lot for development of packaging and testing procedures

– Order 4 lots: 80 wafers with potential for focal plane CCDs (Lots 2A-D)

½ Done: Need to Order Lots 2C and 2D in March 07! To stay on schedule ($240k)

– Process 5+ wafers per lot at LBNL to determine cold probe yield and rate

Almost 1/5 Done: 5 Lot 2A wafers expected at end of Feb. 5 more at end of March.
Lot 2B wafers just delivered to LBNL and sent out for thinning (has been very slow)

Production (once MIE funds are approved):

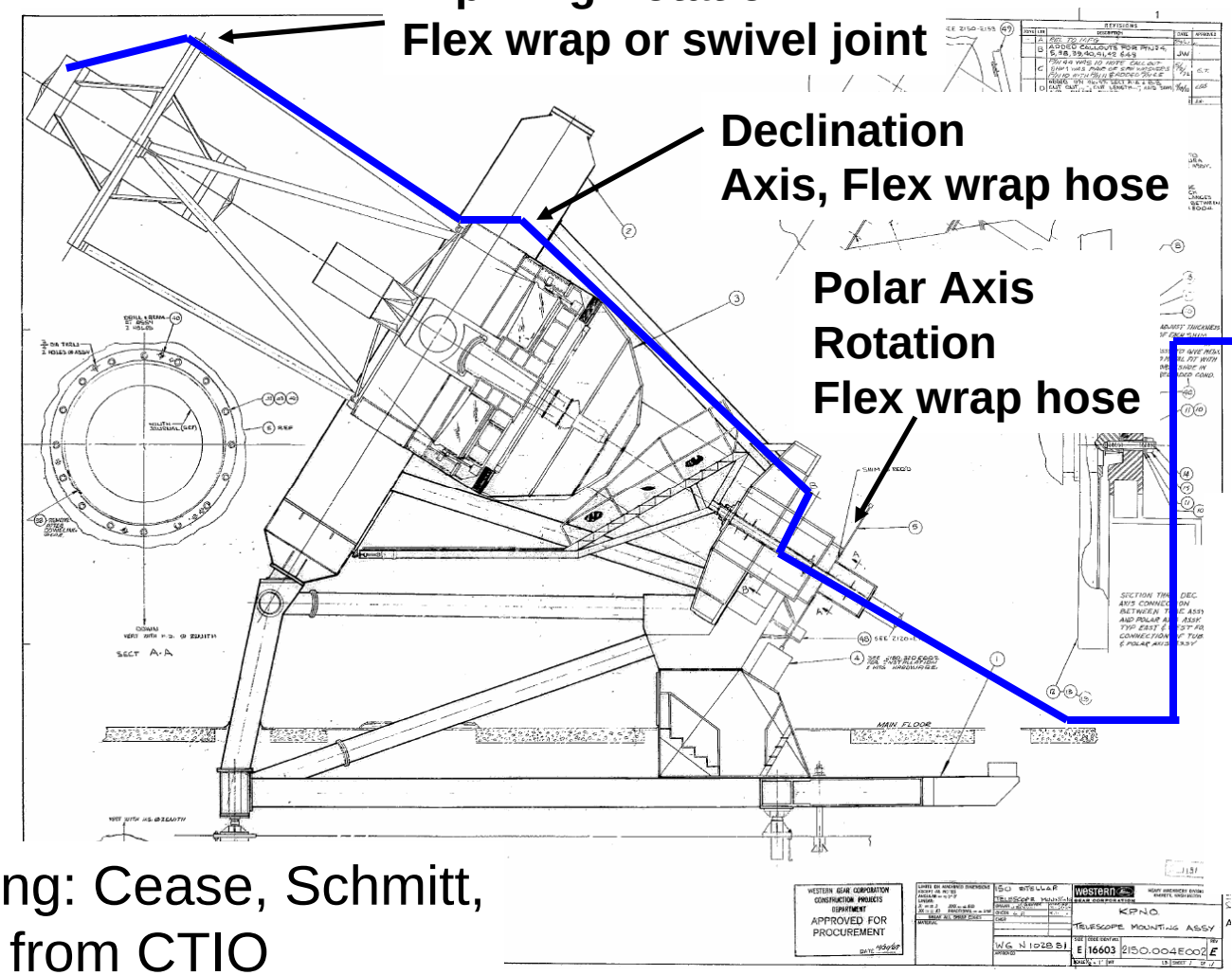
– Order another lot if yield is < 25%

– Initiate processing at LBNL of remaining wafers (schedule assumes Nov 07 start) ~18 months

DARK ENERGY SURVEY

Schematic LN2 Supply System at CTIO

Parameters
2-phase
100 psig
100K



MechEng: Cease, Schmitt,
Advice from CTIO

DARK ENERGY SURVEY

LN2 Cooling R&D: we have a conceptual design, now it needs testing

Cease, Schmidt

1) Confirm heat can be removed from the camera vessel without trapped vapor pockets in the plumbing.
2) Confirm that vibration due to fluid flow and bubble formation is not a problem.
3) Confirm that the plumbing in the region of the flip rings works.

Favorable tests results allow:

Going ahead with smaller camera vessel,
Confirms LN2 can be pumped above the flip ring,
alternative cooling methods are not needed

Electronic Crate Cooling R&D

Simaitis (UIUC) Argonne

Electronics Crates have to handle similar head pressure and orientation changes.

UIUC is developing the crate design, R&D covers cost of 30% of an EE at UIUC and the procurement (FNAL) of a prototype cooling system for testing

Tests determine functionality in all positions, measure heat released

DARK ENERGY SURVEY

Optical Corrector: Conceptual design completed – now have to add access points, different mounts, etc

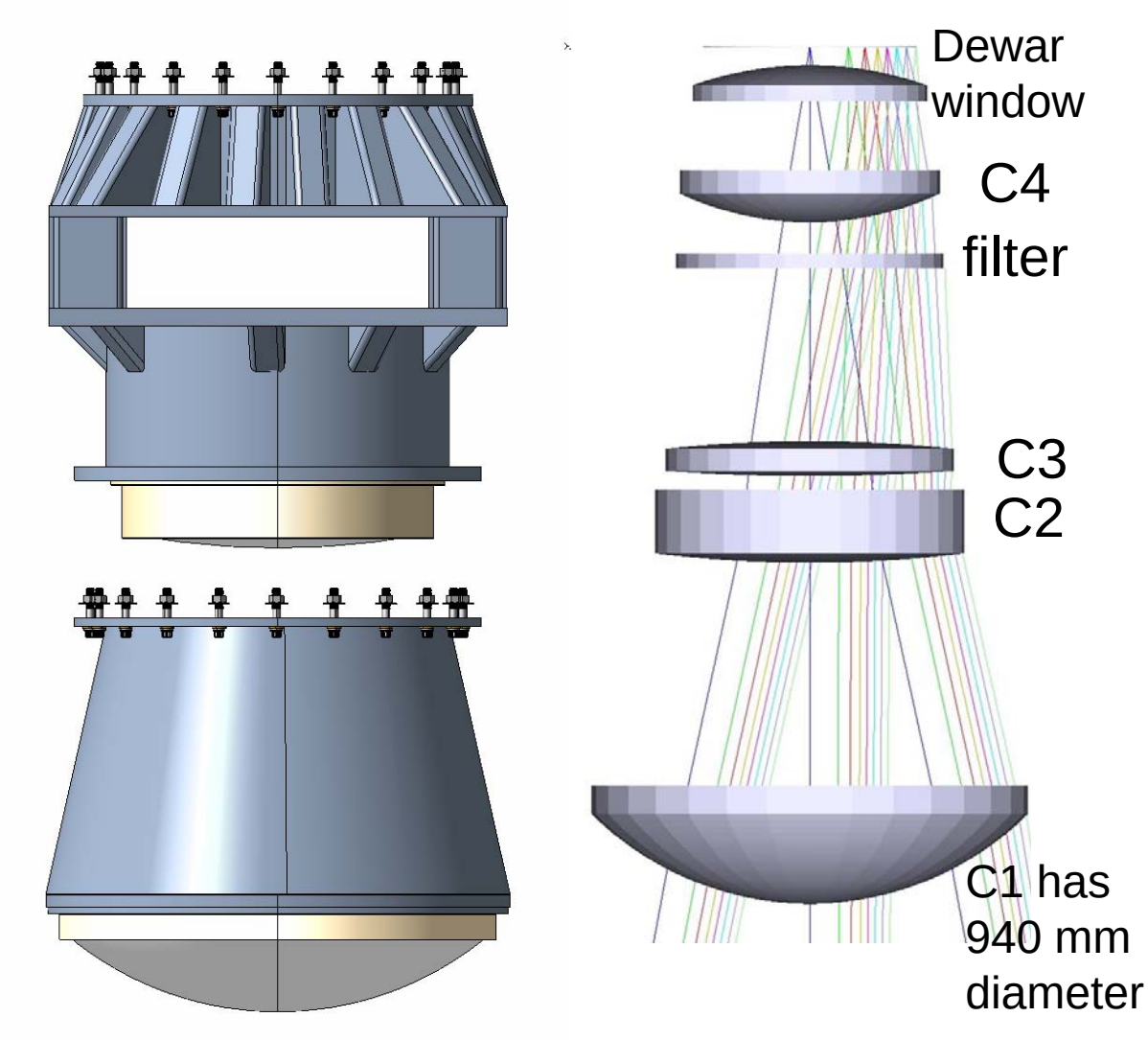
5 elements, fused silica

Barrel must hold lens alignment to ~ 15 microns

Interfaces to Filter changer, CCD vessel, Hexapod

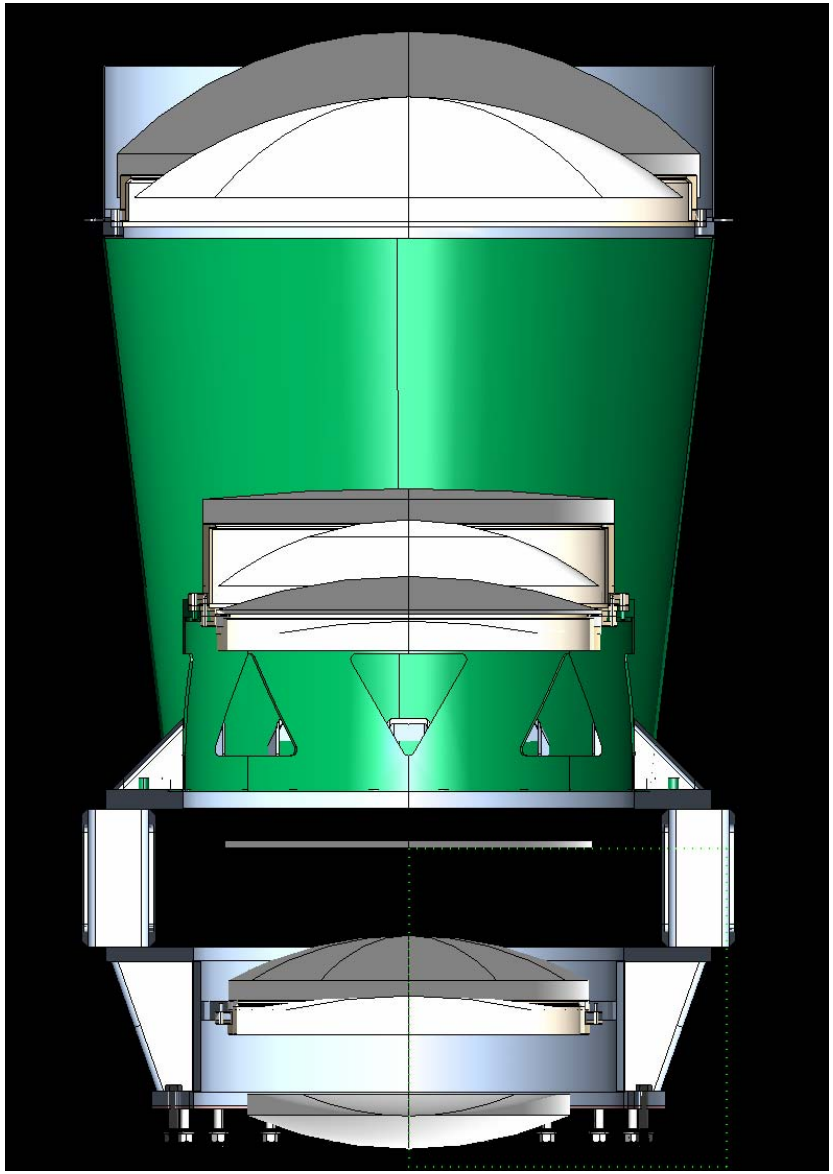
Lenses designed by Bernstein (Mich) and optics group, Procurement will be handled by UK (PPARK)

UMich. is handling the filter procurement and designing the Filter/shutter changer



Barrel and Hexapod R&D

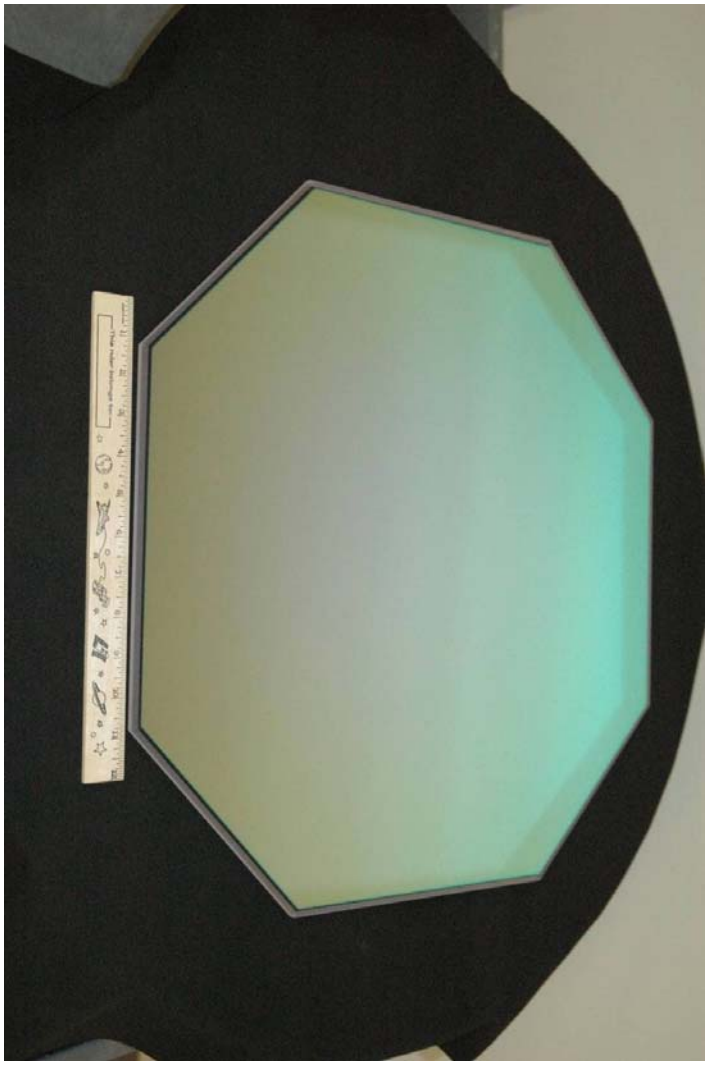
- Barrel Design (Stefanik)
  - works on paper: FEA and vendor quotation.
- We need to develop fabrication procedures and test the final product to ensure success because of tight machining and deflection tolerances:
  - Welding procedures, Stress relieving procedures, Machining procedures, Material selection, QA, Installation access, Measure actual deflections, and cone-body assembly repeatability
- Hexpod (Leger, McGinnis):
  - Supports barrel and CCD vessel (~ 2 tons)
  - want micron level positioning precision
  - No one has demonstrated a hexapod meeting both specifications
  - Plan to contract engineering studies with 1 or 2 vendors



DARK ENERGY SURVEY

Filter R&D

- PanStarrs has received filters
- 570mm max dim.
- DES filters: ~ 620mm
- Uniformity (radial) was not great (Huan evaluating impact on DES science)
- Vendor suggested R&D could eliminate the variation
- R&D plan is to order one DES filter
- Cost covers ME (Bigelow) at Michigan, procurement of one filter, incremental computer costs for simulation and evaluation of impact of non-uniformity on science



SISPI R&D

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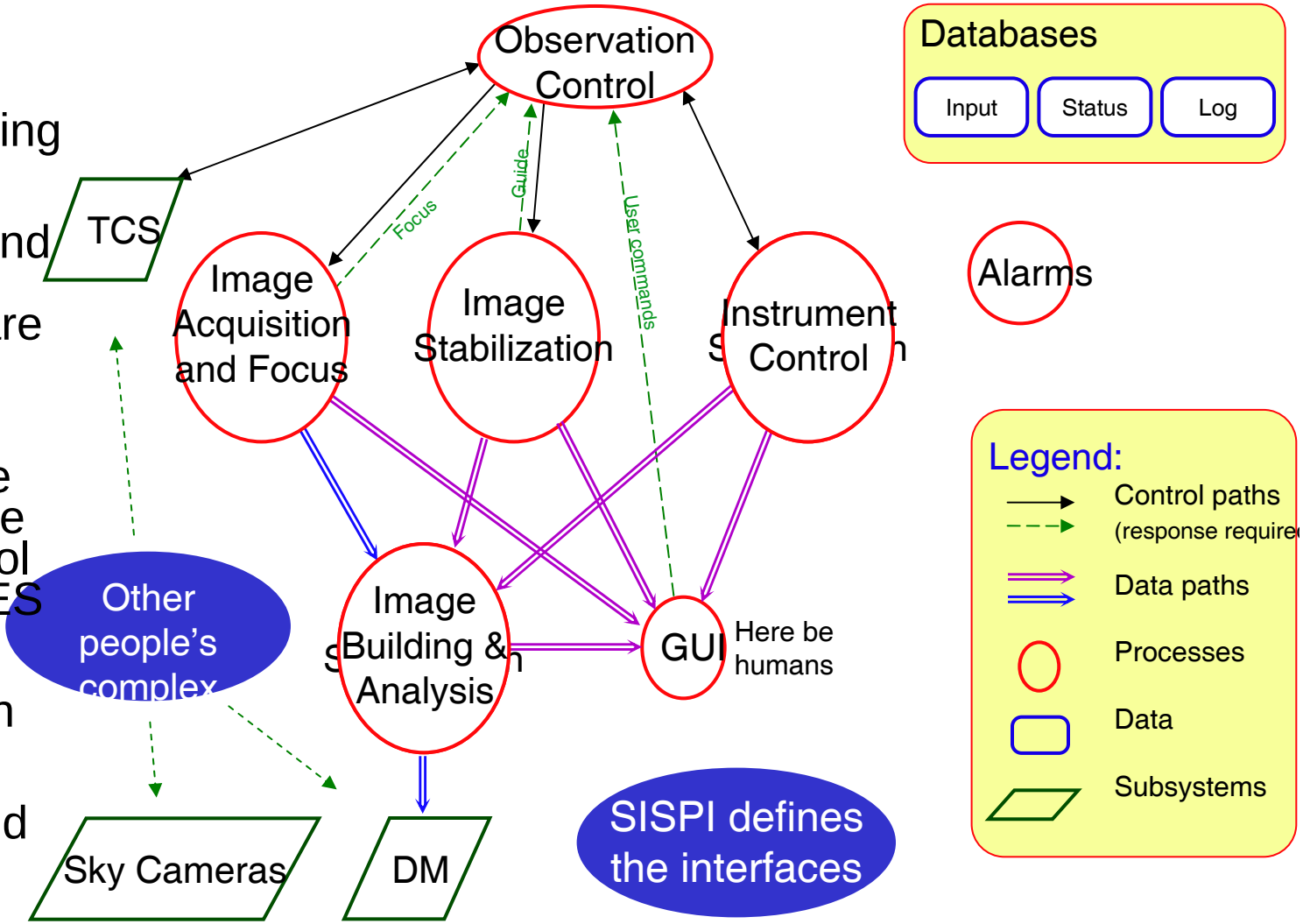
- Want to adapt SOAR messaging system
- DES thru-put and bandwidth requirements are higher
- R&D will determine if the SOAR message passing protocol will work for DES
- Needed before final design can proceed
- Klaus Honshield (OSU), Thaler (UIUC)



DARK ENERGY SURVEY

Conclusions

- We have made a lot of progress in all areas this year
- There is still about a year of R&D to do
- FY07 – 08 is critical to finalizing the design accurately estimating a cost and schedule, and preparing for a construction start in early FY08
- Draft R&D proposal is nearly ready to circulate

DARK ENERGY

Extras

Barrel Design

- Primary function is to hold the optical elements and CCD focal plane within specified tolerance zones at all telescope orientations.
- Very tight machining tolerances required for cell mounting surfaces.
- High deflection stability required for lenses and CCD focal plane.
- Machining:
  - Primary datum surface (C5 cell mounting surface) flatness: 12.5 microns
  - Parallel to primary datum: 12.5 microns
  - Location tolerance along the optical axis: +/- 12.5 microns
- Cone-body bolted joint repeatability:
  - +/- 12.5 microns in lateral directions
- Deflection:
  - +/- 15 microns at 90° inclination (magnitude, primarily in gravity direction)